

## Research paper

# Couples' relationship affects mothers' and fathers' anxiety and depression trajectories over the transition to parenthood

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## ABSTRACT

**Background:** The association between the couple relationship and the mothers' and fathers' psychological adjustment to the transition to parenthood has been examined in the literature. However, the direction of effects between these variables has not been extensively explored. This study aimed to assess the direction of effects between mothers' and fathers' positive and negative interactions and anxiety and depression symptoms trajectories over the transition to parenthood.

**Methods:** A sample of 129 couples ( $N = 258$ ) completed self-report measures of positive and negative interactions, anxiety and depression symptoms at each trimester of pregnancy, at childbirth, and at 3- and 30-months postpartum. Dyadic growth curve models were performed using multilevel modeling.

**Results:** Whereas anxiety and depression showed no moderation effect on positive and negative interactions over time, negative interaction moderated depression from 3- to 30-months postpartum. Mothers and fathers with high negative interaction scores experienced a steeper increase in depression from 3- to 30-months postpartum. Additionally, gender moderated the effect of positive interaction on anxiety from 3- to 30-months postpartum. Fathers with low positive interaction scores experienced an increase in anxiety, whereas fathers with high positive interaction scores and mothers with high or low positive interaction scores did not experience changes in anxiety from 3- to 30-months postpartum.

**Limitations:** Despite the longitudinal aspect of the models, a possible causal relationship need to be taken with caution.

**Conclusions:** Our results suggest that mothers' and fathers' positive and negative interactions affect their anxiety and depression symptoms trajectories: negative interaction raises mothers' and fathers' depression symptoms and positive interaction prevents the increase of fathers' anxiety symptoms over the postpartum period.

## 1. Introduction

The transition to parenthood is a normative transition, requiring several individual, couple and family adjustments (Cowan and Cowan, 2012; Demick, 2002). It begins during pregnancy, or even before, when the pregnancy is planned, and lasts for several years after childbirth. The transition to a second parenthood is considered a transition to parenthood as well, with similar but also with different processes to be implemented to reach psychological adaptation (Cowan and Cowan, 2012; Demick, 2002).

The transition to parenthood is one of the most demanding and stressful life transitions, requiring reorganization of both the inner experience and the external behavior, including the reorganization of

individual and family roles and relationships (e.g., Cigoli and Scabini, 2006; Cowan and Cowan, 2012). The transition increases stress in parents' lives, amplifies differences within the couple, raises marital dissatisfaction (e.g., Doss et al., 2009; Figueiredo and Conde, 2015; Lawrence et al., 2008), and has the potential to place couples at risk for psychological problems (e.g., Figueiredo and Conde, 2011; LeStrat et al., 2011; Perren et al., 2005).

The experience of the transition to parenthood affects and is affected by parents' relationships. The impact of different aspects of the couple relationship on the mothers' and fathers' psychological adjustment to the transition has been highlighted in the recent literature (e.g., Figueiredo et al., 2008; Rösand et al., 2012; Whisman, 2013; Whisman et al., 2011). However, the direction of effects between these variables

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has not been explored in mothers and fathers over the transition to parenthood.

Some studies have identified the influence of parents' anxiety and depression on couples' relationships, suggesting that higher anxiety and/or depression were related to decreased relationship quality over the transition to parenthood (e.g., Bower et al., 2013; Parfitt and Ayres, 2009; Salmela-Aro et al., 2006). Other studies have demonstrated the influence of the couple relationship quality, satisfaction, or adjustment on mothers' and fathers' anxiety and depression symptoms over the transition to parenthood (e.g., Gawlik et al., 2014; Stapleton et al., 2012; Sockol et al., 2014). Only one study suggests that depression is as likely to lead to a decline in the couples' relationship quality as poor couple relationship quality leads to increased depression, in women during the transition to parenthood (Najman et al., 2014).

Regardless of the direction of effects, a concurrent association between the couples' relationship and depression and anxiety was observed in mothers and fathers either in pregnancy and the postpartum period. The couples' relationship dissatisfaction was found to be significantly associated with emotional distress in mothers (e.g., Røsand et al., 2011) and with depression symptoms in fathers during pregnancy (e.g., Costa et al., 2017), whereas a good couple relationship was found to moderate adverse effects of various types of emotional strain on mothers and fathers (e.g., Røsand et al., 2012). Over the postpartum period, poor relationships predicted increased anxiety and/or depression symptoms (e.g., Kingsbury et al., 2015), and were identified as a strong risk factor for postpartum depression (e.g., Norhayati et al., 2015). Poor interaction, low support and intimacy, and high levels of conflict with the spouse were associated with more postpartum depression symptoms in mothers (e.g., Parade et al., 2014), whereas good interactions and spouse support were associated with less postpartum depression symptoms, both in mothers and fathers (e.g., Don and Mickelson, 2012).

A predictive association between couple relationship and depression or anxiety was also observed in mothers and fathers during pregnancy and/or the postpartum period. Poor prenatal couple relationship quality and dissatisfaction influenced postnatal anxiety symptoms in fathers and mothers (e.g., Don et al., 2014) and postnatal depression symptoms in fathers (e.g., Gawlik et al., 2014), whereas a high supportive prenatal couple relationship was found to contribute to postnatal maternal well-being (e.g., Stapleton et al., 2012). Over the transition to parenthood, an adjusted and supportive couple relationship, with more positive and less negative interactions, contributed to decreased emotional distress in mothers and less anxiety and depression symptoms in mothers and fathers (e.g., Figueiredo et al., 2008; Whisman, 2013; Whisman et al., 2011).

Most of the research addressing the association between couples' relationships and psychological adjustment during pregnancy and the postpartum period included only mothers (e.g., Stapleton et al., 2012; Whisman et al., 2011). Some studies have included fathers and did not find gender differences in the concurrent or the predictive associations between couples' relationships and anxiety and depression during pregnancy and/or the postpartum period (Don et al., 2014; Figueiredo et al., 2008; Røsand et al., 2012). Poor marital satisfaction is associated with depression symptoms at the third pregnancy trimester (e.g., Costa et al., 2017) and at the postpartum period (e.g., Parfitt and Ayres, 2014) in fathers, as in mothers. Poor prenatal couple relationship quality or satisfaction was associated with postpartum anxiety and depression symptoms in fathers (Don et al., 2014; Gawlik et al., 2014), as in mothers. But less is known about how the couple relationship influences fathers' psychological adjustment over the transition to parenthood. Gender differences and/or effects may be significant, although little data on fathers are available in the literature. Recent research highlights the need to examine not only mothers', but also fathers' psychological symptoms over the transition to parenthood (e.g., Parade et al., 2014). And, it is also important to include both members of the couple, since both are experiencing the transition to parenthood,

and ultimately because one influences the other reciprocally (Kenny et al., 2006).

Additionally, second time parents have rarely been included in the studies assessing the association between couple relationship quality and anxiety and depression symptoms over pregnancy and the postpartum period. However, second time parents were found to experience more anxiety or depression symptoms as well as more deterioration of their couple relationship over the postpartum period (e.g., DiFlorio et al., 2014; Figueiredo and Conde, 2011; Melo et al., 2012; Mortensen et al., 2012; Sutter-Dallay et al., 2012).

Moreover, most of the existing studies assessed the effect of couple relationship quality or adjustment on depression symptoms using cross-sectional designs (e.g., Costa et al., 2017; Røsand et al., 2011). A limited number of prospective studies assessed couples' relationships at one assessment wave as a predictor of subsequent onset of anxiety or depression symptoms. To our knowledge, only three recent longitudinal studies have considered the effect of couples' relationships on anxiety or depression trajectories over the transition to parenthood. One study showed the effect of negative couples' relationships on maternal depression symptoms, from the third trimester of pregnancy to 6-months postpartum (Parade et al., 2014). Another study showed the impact of prenatal couple relationship satisfaction on anxiety symptoms from the third trimester to 9-months postpartum in both mothers and fathers (Don et al., 2014). And, another study showed the effect of couple conflict on maternal depression across 21 years after delivery (Kingsbury et al., 2015).

However, none of the previous studies tested simultaneously the concurrent effects of the couples' relationship on anxiety and depression symptoms, as well as the concurrent effects of anxiety and depression symptoms on the couples' relationship over the transition to parenthood. Likewise, the couples' interdependence and reciprocal influence on the dyad over the transition to parenthood have not been considered. These are the principal novelties of the present study.

Moreover, the clarification of the direction of effects between the mothers' and fathers' positive and negative interactions and anxiety and depression trajectories may contribute to recognize the main determinant process involved in couples' adjustment to the transition to parenthood and to inform clinical practice. The recognition of this main determinant process is the first step to design effective promotion or prevention programs to strength parents' psychological adjustment during the transition to parenthood.

The purpose of this study was to assess the moderation effects: (a) of anxiety and depression symptoms on mothers' and fathers' positive and negative interactions trajectories from the first trimester of pregnancy to 30-months postpartum, (b) of the positive and negative interactions on mothers' and fathers' anxiety and depression symptoms trajectories from the first trimester of pregnancy to 30-months postpartum and (c) of gender, controlling for parity.

## 2. Method

### 2.1. Procedure

This research received previous approval from the institution Ethical Commission. A sample of 260 couples was recruited during the first trimester of pregnancy and surveyed from the first trimester until 30-months postpartum. Participants were recruited in an Obstetrics Out-patient Unit of a public health service at their first pregnancy appointment. The exclusion criteria were not reading or writing Portuguese and multiple gestations. The aims and the procedures of the study were explained, and a signed informed consent was independently obtained from the mother and the father. After signing the informed consent, participants individually completed a socio-demographic questionnaire, and self-report measures to assess couples' positive and negative interactions and anxiety and depression symptoms. The same self-report measures were then sent using an on-line

electronic form during the second and third pregnancy trimesters, as well as after childbirth and at 3- and 30-months postpartum. These assessment waves were selected (1) to assess couples during the beginning and the end of the transition to parenthood and (2) to maintain a time frame of 3 months between each assessment wave.

## 2.2. Measures

### 2.2.1. Socio-demographic variables

Information about the participants (e.g., age, marital status, socioeconomic level, occupational status, years of education, and previous history of anxiety and depression) was collected using a socio-demographic questionnaire.

### 2.2.2. Couples' positive and negative interactions

The Relationship Questionnaire (RQ; Figueiredo et al., 2008) is a brief self-report questionnaire, comprised of 12 items rated on a 4-point Likert-type scale (from one to four) that assesses couples' positive (positive subscale, 8 items) and negative (negative subscale, 4 items) interactions. The total score for each dimension is computed by averaging the scores of the items of each subscale. This questionnaire was designed to be completed in a short time, is behaviorally focused and appropriate for mothers and fathers, and has been used to assess couples' positive and negative interactions during the transition to parenthood (e.g., Figueiredo and Conde, 2015). The positive interaction subscale includes sense of support and care, affection, closeness and joint interests and activities (e.g., Do you and your partner show affection to each other?). The negative interaction subscale includes irritability, arguments and criticisms (e.g., Do you and your partner get irritable with each other?). Higher scores on these subscales reflect more positive or more negative interactions (Figueiredo et al., 2008). The RQ has shown good internal consistency (with a Cronbach's alpha of 0.79 for the total scale, 0.90 for the positive subscale and 0.72 for the negative subscale), as well as good test-retest reliability ( $r = 0.74$ ) for the total scale (Figueiredo et al., 2008). In the present sample, Cronbach's alphas ranged from 0.70 to 0.92 for mothers and fathers on the positive and negative subscales.

### 2.2.3. Anxiety symptoms

The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983) is a self-report questionnaire that consists of two subscales, the state anxiety and the trait anxiety, each including 20 items. The state anxiety subscale (STAI-S) was used in this study to assess anxiety symptoms. The Portuguese version has shown good internal consistency for mothers and fathers (e.g., Tendais and Figueiredo, 2016), and has been identified as a screening tool of reasonable validity for anxiety in mothers during pregnancy and the postpartum period (Tendais et al., 2014). In the present sample, Cronbach's alphas ranged from 0.88 to 0.94 for mothers and fathers.

### 2.2.4. Depression symptoms

The Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) is a self-report questionnaire comprised of 10 items that assess depression symptoms within the previous seven days. The EPDS Portuguese version has shown good internal consistency for mothers and fathers (Pinto et al., 2016; Tendais and Figueiredo, 2016), and reasonable validity as a screening tool for depression in mothers during pregnancy and the postpartum period (Tendais et al., 2014). In the present sample, Cronbach's alphas ranged from 0.78 to 0.88 for mothers and fathers.

## 2.3. Statistical analyses

Dyadic growth curve models were tested using multilevel modeling (MLM; Kenny et al., 2006; Kurdek, 2003) with IBM SPSS Statistics for Windows, v.19.0. These models were performed to estimate the moderation effects of anxiety and depression scores (time-varying

moderators) on mothers' and fathers' positive and negative interactions score changes over time, and of positive and negative interactions scores (time-varying moderators) on mothers' and fathers' anxiety and depression score changes over time. Two-level models were estimated for the outcome variables, in which level 1 referred to the participants' scores at each time point and level 2 to the dyad's scores (combined mothers' and fathers' scores). Individual differences for mothers and fathers were modeled at the dyad level.

Different models were performed to assess the effects of the moderators on each outcome variable. In each model, time 0 was defined as the date of the first assessment at the first trimester of pregnancy (baseline) and the time variable was scored in months. Piecewise linear growth curve models were performed to simultaneously analyze two linear trajectories: the changes in the outcome variables from baseline to 3-months postpartum, and from 3- to 30-months postpartum. Piecewise linear models revealed a better model fit than linear models and allowed a better representation of the data considering the rate of dropout between the fifth and the sixth assessment waves (Duncan et al., 2006). Fixed effects for gender (coded as  $-1$  for women and  $+1$  for men) and the time-varying moderators (scores of moderators at each assessment wave) were also included in the models, as well as all possible interactions. The STAI-S and the EPDS scores at each assessment wave were included as time-varying moderators in the models assessing the moderating effects of anxiety and depression scores on positive and negative interactions score changes over time. Likewise, the positive and negative RQ scores at each assessment wave were included as time-varying moderators in the models assessing the moderating effects of positive and negative interaction scores on anxiety and depression score changes over time. Models were adjusted for parity (coded as  $-1$  for first-time parents and  $+1$  for second-time parents), mothers' and fathers' age, and socioeconomic and occupational status, since the participants who were younger, unemployed, or from lower socioeconomic levels were more likely to drop out of the study.

Different models were performed for each outcome variable in the interest of parsimony. The significant interactions with continuous predictors (centered on their grand means from the baseline to 30-months postpartum) were interpreted and graphed using one standard deviation above and below the grand mean as high and low values for those variables (Aiken and West, 1991). The deviance difference tests revealed that the selected models provided good fit to the data, indicating that in each model the predictors explained variance. Results were reported at a  $p < 0.05$  significance level.

## 3. Results

### 3.1. Participants' characteristics

The sample is representative of Portuguese parents (NIS, 2016). Most of the participants were Portuguese (91.4%), aged between 20 and 39 years old (85.9%), employed (80.4%), and married or cohabiting (88.4%). More than 50% were from low or medium-low socio-economic levels (57.4%), had nine or more years of education (67.2%), and were first-time parents (55.0%; see Table 1). Most of the mothers delivered their babies after the 37th week of gestation (97.0%), initiated breastfeeding (95.7%) and reported good health and developmental outcomes of their child at 30-months postpartum (95.0%).

The study had six assessment waves: first (8–14 weeks gestation,  $M = 13.90$ ,  $SD = 1.38$ ) second (20–24 weeks gestation,  $M = 21.21$ ,  $SD = 1.14$ ) and third trimester of pregnancy (30–34 weeks gestation,  $M = 31.14$ ,  $SD = 1.65$ ), childbirth (1–3 days postpartum,  $M = 2.30$ ,  $SD = 0.51$ ), and at 3- (10–14 weeks postpartum,  $M = 13.60$ ,  $SD = 0.80$ ) and 30-months postpartum (24–36 months postpartum,  $M = 30.20$ ,  $SD = 5.51$ ). A total of 215 couples ( $n = 430$ , 82.7%) completed all assessment waves until 3-months postpartum, and a total of 129 couples completed all assessment waves until 30-months

**Table 1**  
Participants' socio-demographic characteristics at baseline.

	Mothers <i>n</i> = 260%	Fathers <i>n</i> = 260%	Total <i>N</i> = 520%
Age (years)			
≤ 19	11.5	4.2	7.9
20–29	47.0	38.9	42.9
30–39	39.2	46.9	43.1
≥ 40	2.3	10.0	6.1
Matrimonial status			
Cohabiting	32.6	32.5	32.5
Married	55.8	55.7	55.8
Single	11.2	10.2	10.7
Divorced	0.4	1.6	1.0
Socio-economic level			
High	9.3	16.4	12.5
Medium-high	14.0	7.4	11.1
Medium	18.6	19.6	19.0
Medium-low	30.3	26.4	28.6
Low	27.8	30.2	28.8
Occupational status			
Employed	71.8	89.0	80.4
Unemployed	21.6	9.0	15.4
Household/student	2.0	6.6	4.2
Years of education			
< 9	26.9	38.6	32.8
9–12	54.3	47.9	51.0
> 12	18.8	13.5	16.2

postpartum (*n* = 258, 49.6%). Participants who completed all assessments until 30-months postpartum were more likely to be older,  $\chi^2(3) = 33.05$ ,  $p < 0.001$ , employed,  $\chi^2(6) = 16.32$ ,  $p = 0.012$ , and belong to medium or high socio-economic levels,  $\chi^2(2) = 26.45$ ,  $p < 0.001$ . Also, they reported less anxiety and depression symptoms at the first trimester of pregnancy,  $t(503) = 2.19$ ,  $p = 0.03$ ,  $t(503) = 4.05$ ,  $p < 0.001$ , but not at 3-months postpartum. Those who completed all assessment waves until 30-months postpartum were not different than those who did not complete all assessment waves on positive and negative interactions at baseline and at 3-months postpartum.

### 3.2. Preliminary analyses

Descriptive statistics were calculated (means and standard deviations) regarding mothers' and fathers' positive and negative interactions, anxiety and depression scores at each assessment wave (see Table 2).

Significant small to large size correlations were found between the mothers' and fathers' scores at the first trimester of pregnancy, revealing that these scores covary. Within-mothers and within-fathers positive and negative interaction, anxiety and depression scores were also correlated at the first trimester of pregnancy (see Table 3).

**Table 2**  
Means and standard deviations of study variables across time for mothers and fathers.

Variables	Pregnancy trimesters						Postpartum					
	First		Second		Third		Childbirth		3-months		30-months	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Mothers</b>												
Positive interaction (RQ-positive scores)	3.67	0.35	3.61	0.44	3.63	0.42	3.61	0.41	3.57	0.49	3.34	0.67
Negative interaction (RQ-negative scores)	2.12	0.52	2.07	0.49	2.06	0.53	2.05	0.53	2.04	0.49	2.13	0.52
Anxiety symptoms (STAI-S scores)	36.04	8.88	34.68	9.37	36.24	9.03	35.76	10.25	30.84	8.36	34.45	9.48
Depression symptoms (EPDS scores)	6.42	4.19	6.00	4.32	5.49	4.25	5.87	4.67	4.72	4.21	6.11	4.36
<b>Fathers</b>												
Positive interaction (RQ-positive scores)	3.64	0.39	3.65	0.43	3.65	0.40	3.66	0.39	3.66	0.39	3.44	0.59
Negative interaction (RQ-negative scores)	2.19	0.57	2.11	0.54	2.08	0.53	2.06	0.48	2.08	0.50	2.13	0.51
Anxiety symptoms (STAI-S scores)	33.10	8.82	31.17	8.07	32.61	7.95	32.72	9.13	29.37	7.99	33.77	9.44
Depression symptoms (EPDS scores)	5.24	3.96	4.18	3.31	4.08	3.26	4.06	3.73	3.51	3.46	4.80	4.21

**Table 3**  
Correlations between study variables for mothers and fathers at the first trimester of pregnancy.

	1	2	3	4
1. Couples' positive interaction (RQ-positive scores)	<b>0.45***</b>	−0.25***	−0.34***	−0.32***
2. Couples' negative interaction (RQ-negative scores)	−0.29***	<b>0.25***</b>	0.38***	0.39***
3. Anxiety symptoms (STAI-S scores)	−0.19***	0.28***	<b>0.16*</b>	0.64***
4. Depression symptoms (EPDS scores)	−0.31***	0.36***	0.63***	<b>0.31***</b>

Notes. Values on the diagonal (in bold) represent correlations between men and women, values above the diagonal represent within-women correlations, and values below the diagonal represent within-men correlations.

\*  $p < 0.05$

\*\*\*  $p < 0.001$

Significant random effects were found in all the models, including correlations between mothers' and fathers' scores on positive and negative interactions, anxiety, and depression. In all models, mothers' and fathers' scores were positively correlated at the first trimester of pregnancy ( $r$ s ranged from 0.24 to 0.59,  $p$ s < 0.05). The estimated residual correlation was significant ( $r$ s ranged from 0.14 to 0.30,  $p$ s < 0.001), indicating that positive and negative interaction, anxiety, and depression scores were similar within-dyads (see Tables 4 and 5).

### 3.3. Does anxiety and depression moderate positive and negative interactions over time?

Non-significant effects of the interactions between time and anxiety symptoms,  $b = -0.00$ ,  $SE = 0.00$ ,  $p = 0.22$ , and between time and depression symptoms,  $b = -0.00$ ,  $SE = 0.00$ ,  $p = 0.99$ , were found on positive interaction scores from the first trimester of pregnancy to 3-months postpartum. Likewise, non-significant effects of the interactions between time and anxiety symptoms,  $b = -0.00$ ,  $SE = 0.00$ ,  $p = 0.08$ , and between time and depression symptoms,  $b = -0.00$ ,  $SE = 0.00$ ,  $p = 0.47$ , were found on positive interaction scores from 3- to 30-months postpartum, revealing no moderation effects of anxiety and depression symptoms on positive interaction over time.

Non-significant effects of the interactions between time and anxiety symptoms,  $b = -0.00$ ,  $SE = 0.00$ ,  $p = 0.21$ , and between time and depression symptoms,  $b = -0.00$ ,  $SE = 0.00$ ,  $p = 0.18$ , were found on negative interaction scores from the first trimester of pregnancy to 3-months postpartum. Likewise, non-significant effects of the interactions between time and anxiety symptoms,  $b = 0.00$ ,  $SE = 0.00$ ,  $p = 0.63$ , and between time and depression symptoms,  $b = 0.00$ ,  $SE = 0.00$ ,  $p = 0.37$ , were found on negative interaction scores from 3- to 30-

**Table 4**

Anxiety symptoms from early pregnancy to 30-months postpartum moderated by either couples' positive or negative interaction.

Fixed effects	Moderator					
	Couples' positive interaction			Couples' negative interaction		
	<i>b</i>	<i>SE</i>	95% <i>CI</i>	<i>b</i>	<i>SE</i>	95% <i>CI</i>
Intercept	32.82	1.61	[29.66, 35.97]***	32.86	1.58	[29.74, 35.98]***
Time from first trimester to 3-months postpartum	−0.31	0.05	[−0.41, −0.21]***	−0.27	0.05	[−0.37, −0.18]***
Time from 3 to 30-months postpartum	0.03	0.03	[−0.02, 0.08]	0.07	0.02	[0.02, 0.11]**
Gender	−1.59	0.32	[−2.22, −0.95]***	−1.66	0.32	[−2.28, −1.03]***
Moderator	−3.40	0.75	[−4.88, −1.92]***	2.75	0.52	[1.73, 3.77]***
Gender × Moderator	−1.37	0.70	[−2.74, −0.06]	−0.18	0.50	[−1.17, 0.81]
Gender × Time from first trimester to 3-months postpartum	0.09	0.05	[−0.01, 0.18]	0.07	0.04	[−0.02, 0.16]
Gender × Time from 3 to 30-months postpartum	0.04	0.02	[0.00, 0.08]*	0.03	0.02	[−0.01, 0.07]
Moderator × Time from first trimester to 3-months postpartum	−0.13	0.12	[−0.37, 0.10]	0.07	0.09	[−0.11, 0.24]
Moderator × Time from 3 to 30-months postpartum	−0.01	0.04	[−0.09, 0.07]	0.02	0.04	[−0.07, 0.10]
Gender × Moderator × Time from first trimester to 3-months postpartum	0.05	0.11	[−0.18, 0.27]	−0.01	0.09	[−0.20, 0.16]
Gender × Moderator × Time from 3 to 30-months postpartum	0.08	0.04	[0.01, 0.15]*	−0.02	0.04	[−0.09, −0.06]
Random effects						
Intercept		Men	Women		Men	Women
		37.57***	46.66***		36.08***	41.66***
Slope for time from first trimester to 3-months postpartum		0.20*	0.30**		0.17*	0.28*
Slope for time from 3- to 30-months postpartum		0.07**	0.04*		0.06**	0.04*
Residuals		30.57***	42.86***		30.96***	42.95***

Notes. The models are adjusted to parity; Gender = −1 female, 1 male.

\*  $p < 0.05$ \*\*  $p < 0.01$ \*\*\*  $p < 0.001$ 

months postpartum, revealing no moderation effects of anxiety and depression symptoms on negative interaction over time.

### 3.4. Does positive and negative interactions moderate anxiety and depression over time?

Main effects of positive interaction scores,  $b = -3.40$ ,  $SE = 0.75$ ,  $p < 0.001$ , and negative interaction scores,  $b = 2.75$ ,  $SE = 0.52$ ,  $p < 0.001$ , on anxiety symptoms were noted at the first trimester of pregnancy. Participants with lower and higher positive and negative interaction scores presented more anxiety symptoms at the first trimester of pregnancy. Non-significant interactions were found between

time and positive or negative interaction scores from the first trimester of pregnancy to 3-months postpartum or from 3- to 30-months postpartum, revealing no moderation effects of positive or negative interaction scores on anxiety symptoms over time. (see Table 4).

Main effects of positive interaction scores,  $b = -2.15$ ,  $SE = 0.30$ ,  $p < 0.001$ , and negative interaction scores,  $b = 1.54$ ,  $SE = 0.22$ ,  $p < 0.001$ , were found on depression symptoms at the first trimester of pregnancy. Participants with lower positive and higher negative interaction scores presented more depression symptoms at the first trimester of pregnancy (see Table 5).

Significant effects of the interaction between time and negative interaction scores were found on depression symptoms from 3- to 30-

**Table 5**

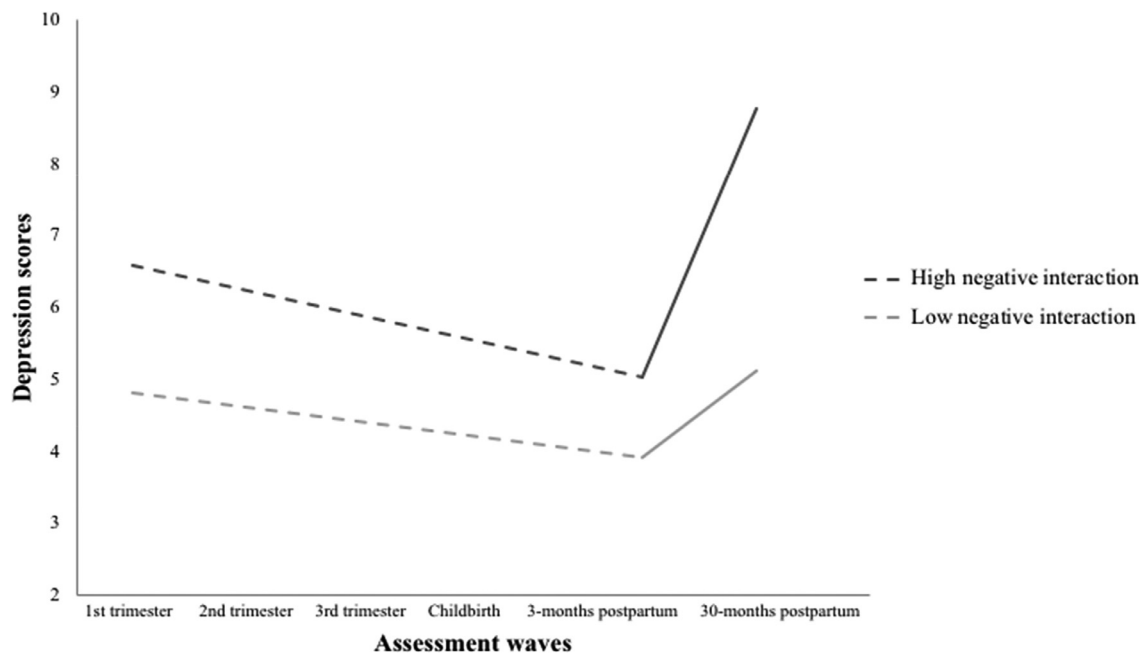
Depression symptoms from early pregnancy to 30-months postpartum moderated by either couples' positive or negative interaction.

Fixed effects	Moderator					
	Couples' positive interaction			Couples' negative interaction		
	<i>b</i>	<i>SE</i>	95% <i>CI</i>	<i>b</i>	<i>SE</i>	95% <i>CI</i>
Intercept	6.35	0.86	[4.67, 8.05]***	6.71	0.87	[5.00, 8.43]***
Time from first trimester to 3-months postpartum	−0.14	0.02	[−0.18, −0.10]***	−0.12	0.02	[−0.16, −0.08]***
Time from 3 to 30-months postpartum	0.04	0.01	[0.02, 0.06]**	0.05	0.01	[0.03, 0.06]***
Gender	−0.83	0.14	[−1.11, −0.55]***	−0.83	0.14	[−1.11, −0.55]***
Moderator	−2.15	0.30	[−2.73, −1.56]***	1.54	0.22	[1.11, 1.98]***
Gender × Moderator	0.13	0.28	[−0.43, 0.68]	0.49	0.21	[−0.91, −0.07]
Gender × Time from first trimester to 3-months postpartum	0.03	0.02	[−0.01, 0.06]	0.01	0.01	[−0.01, 0.02]
Gender × Time from 3 to 30-months postpartum	0.01	0.02	[−0.01, 0.02]	0.004	0.01	[−0.01, 0.02]
Moderator × Time from first trimester to 3-months postpartum	0.03	0.05	[−0.06, 0.13]	−0.02	0.04	[−0.10, 0.05]
Moderator × Time from 3 to 30-months postpartum	0.00	0.02	[−0.03, 0.04]	0.04	0.02	[0.00, 0.07]*
Gender × Moderator × Time from first trimester to 3-months postpartum	−0.03	0.04	[−0.11, 0.06]	−0.00	0.04	[−0.07, 0.07]
Gender × Moderator × Time from 3 to 30-months postpartum	0.01	0.01	[−0.02, 0.03]	0.02	0.02	[−0.01, 0.05]
Random effects						
Intercept		Men	Women		Men	Women
		7.52***	8.90***		6.97***	8.51***
Slope for time from first trimester to 3-months postpartum		0.05***	0.05*		0.04**	0.05**
Slope for time from 3- to 30-months postpartum		0.01***	0.03		0.01***	0.00
Residuals		2.17***	6.25***		3.86***	6.30***

Note. The models are adjusted to parity; Gender = −1 female, 1 male;

\*  $p < 0.05$ \*\*  $p < 0.01$ \*\*\*  $p < 0.001$





**Fig. 1.** Linear changes in depression symptoms from early pregnancy to 30-months postpartum moderated by couples' negative interaction. Negative interaction moderated depression from 3- to 30-months postpartum. Significant differences are presented with a continuous line.

months postpartum,  $b = 0.04$ ,  $SE = 0.02$ ,  $p < 0.05$ , revealing a moderation effect of negative interaction scores on depression symptoms from 3- to 30-months postpartum. Mothers and fathers with high negative interaction scores experienced a steeper increase in depression symptoms from 3- to 30-months postpartum, than those with low negative interaction scores (see Fig. 1).

Anxiety and depression symptoms had no moderation effects on positive and negative interaction scores over time. Thus, further analyses of fit comparisons between these models were not performed.

### 3.5. Does gender moderate positive and negative interaction effects on anxiety and depression over time?

Significant effects of the interaction between time, positive interaction scores, and gender were found on anxiety symptoms from 3- to 30-months postpartum (see Table 4). Positive interaction scores moderated fathers' anxiety symptoms from 3- to 30-months postpartum,  $b = 0.11$ ,  $SE = 0.05$ ,  $p = 0.02$ , but not mothers' anxiety symptoms,  $b = -0.03$ ,  $SE = 0.05$ ,  $p = 0.45$ . Fathers with low positive interaction scores from 3- to 30-months postpartum experienced an increase in anxiety symptoms and presented more anxiety symptoms than other groups at 30-months postpartum,  $b = 0.09$ ,  $SE = 0.04$ ,  $p = 0.02$ , whereas the anxiety symptoms did not change for fathers with high positive interaction scores from 3- to 30-months postpartum,  $b = 0.01$ ,  $SE = 0.04$ ,  $p = 0.14$ . Mothers with low,  $b = 0.04$ ,  $SE = 0.04$ ,  $p = 0.23$ , or high,  $b = 0.04$ ,  $SE = 0.04$ ,  $p = 0.29$ , positive interaction scores from 3- to 30-months postpartum experienced a non-significant increase in anxiety symptoms over the same period (see Fig. 2).

## 4. Discussion

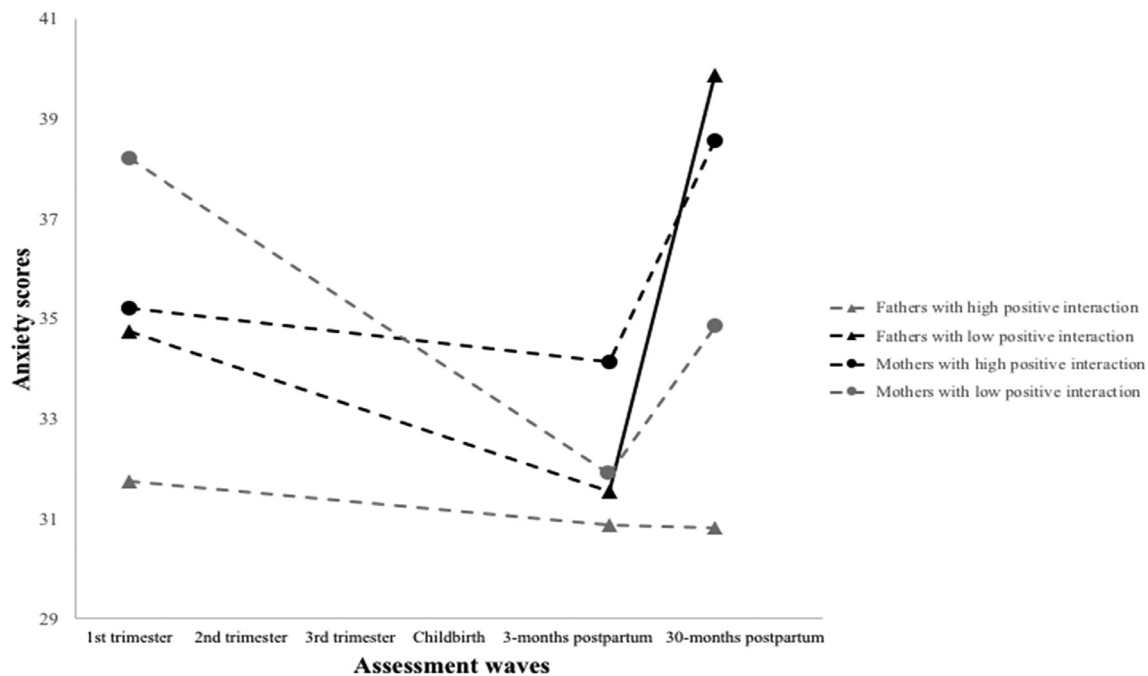
The purpose of this study was to assess the direction of effects between mothers' and fathers' positive and negative interactions and anxiety and depression symptoms trajectories over the transition to parenthood. Anxiety and depression had no moderation effects on mothers' and fathers' positive and negative interaction scores over time. Conversely, couples' negative interaction scores moderated mothers' and fathers' depression from 3- to 30-months postpartum. Mothers and fathers who had high negative interaction scores had a greater increase

in depression symptoms from 3- to 30-months postpartum. Additionally, gender moderated the effect of positive interaction scores on anxiety symptoms from 3- to 30-months postpartum. Fathers who had lower positive interaction scores had a greater increase in anxiety symptoms from 3- to 30-months postpartum while mothers' anxiety symptoms did not change significantly.

According to our results, positive and negative interactions affected anxiety and depression symptoms changes over the postpartum period (from 3- to 30-months postpartum) while anxiety and depression symptoms had no influence on positive and negative interaction changes over the transition to parenthood. These findings are inconsistent with some previous results suggesting that anxiety and depression symptoms affected couples' relationship quality over the transition to parenthood (e.g., Bower et al., 2013; Parfitt and Ayres, 2009; Salmela-Aro et al., 2006). Including data from early pregnancy and controlling for dyadic interdependence may have provided a larger control for possible confounders in the present study, accounting for these discrepant findings with previous studies.

In the present study, mothers and fathers who had lower positive and higher negative interaction scores during the first trimester of pregnancy had more anxiety and depression symptoms. These results are consistent with previous studies that revealed effects of couple relationship satisfaction or quality on mothers' and fathers' emotional distress, anxiety or depression symptoms in pregnancy (Figueiredo et al., 2008; Røsand et al., 2012; Sockol et al., 2014). During the first trimester of pregnancy, mothers and fathers may experience difficulties with pregnancy acceptance, frequently characterized by affective ambivalence (Slade et al., 2009). Positive interactions may have a buffer effect, allowing couples to better accept the pregnancy and to have less difficulty to adjust to the transition to parenthood.

Moreover, both mothers and fathers with high negative interaction scores experienced a higher increase in depression from 3- to 30-months postpartum. These results corroborate and extend previous findings that identified an association between couple conflict or relationship dissatisfaction and depression symptoms over the transition to parenthood, particularly in the postpartum period (e.g., Kingsbury et al., 2015; Najman et al., 2014). Adjusting to the demands of parenting may deteriorate couple relationship quality (Don and Mickelson, 2012). Especially after the maternity and/or paternity leave or absence,



**Fig. 2.** Linear changes in fathers' and mothers' anxiety symptoms from early pregnancy to 30-months postpartum moderated by couples' positive interaction. Gender moderated the effect of positive interaction on anxiety from 3- to 30-months postpartum. Significant differences are presented with a continuous line.

parents may experience difficulties such as negotiating work schedules, increased financial challenges, adapting to the infant's difficulties, negotiating the division of household labor and adjusting to the co-parenting experience (Belsky, 1985; Möller et al., 2006; Van Egeren, 2004). These difficulties can contribute to more irritability, arguments, criticisms and conflicts between parents, leading to negative experiences and subsequently to increased depression symptoms (Don and Mickelson, 2012; Stapleton et al., 2012).

However, positive or negative interactions had no moderating effect on mother's and father's anxiety and depression changes from the first trimester of pregnancy to 3-months postpartum. Previous data reported a significant impact of couple relationship quality on anxiety and depression symptoms from pregnancy to the early postpartum period (Don et al., 2014; Stapleton et al., 2012; Whisman, 2013; Whisman et al., 2011). Discrepancies between the current results and those of other studies may relate to the previous studies only including one assessment of the couple relationship and not early in pregnancy and not considering the concurrent effect of couple relationship changes on anxiety and depression symptoms changes.

The moderation effect of negative interaction on depression symptoms from 3- to 30-months postpartum was similar for mothers and fathers. These results are consistent with other studies that have suggested no gender effects on the association between couple relationship dissatisfaction and depression symptoms over the postpartum period (e.g., Bower et al., 2013; Parfitt and Ayres, 2014; Salmela-Aro et al., 2006). These previous findings refer to the postpartum period, at 5/6 or 13-months postpartum, whereas our findings cover the period between 3- and 30-months postpartum. Our results suggest that mothers and fathers are equally vulnerable to an increase in depression symptoms over the postpartum period following an increase in couple negative interactions.

Gender moderated the effect of couples' positive interaction on anxiety symptoms from 3- to 30-months postpartum. Fathers, but not mothers, with low positive interaction scores had a greater increase in anxiety from 3- to 30-months postpartum. Some studies have reported that anxiety symptoms are relatively more common in fathers over the postpartum period (Figueiredo and Conde, 2011; Leach et al., 2016; Wynter et al., 2013). One of the predictors of postpartum anxiety in

fathers is low support from the spouse (e.g., Helle et al., 2016). After childbirth, parents' attention tends to shift from the self and the spouse to the baby and their needs, leading parents to a lesser amount of positive interactions (Kluwer, 2010). These changes can be a greater risk for fathers' psychological adjustment during the postpartum period, particularly through a decline in the sense of support and care, affection, closeness, joint interests and activities (Biehle and Mickelson, 2011; Bielawska-Batorowicz and Kossakowska-Petryca, 2006; Don and Mickelson, 2012).

#### 4.1. Strengths and limitations

The strengths of this study included the six-wave longitudinal design, the large sample size, self-reports by mothers and fathers and first and second time parents, and the use of multilevel modeling controlling for concurrent effects. In addition, both members of the couple served as the unit of analysis, controlling for couple interdependence. The limitations included the large time span between the fifth and the sixth assessment wave, when the dropout rate was high, and the data obtained through self-report measures.

#### 4.2. Implications for clinical practice and research

This study's results have important implications for clinical practice. First, screening for positive and negative interactions early in pregnancy but also at 3-months postpartum seems relevant to identify both mothers and fathers at risk of psychological problems during the transition to parenthood. Second, decreasing couple negative interaction seems relevant to reduce the risk of depression in fathers and mothers and improving positive interaction seems relevant to reduce the risk of anxiety in fathers during the postpartum period. These can be the first steps to include in promotion and prevention programs during the transition to parenthood. Since positive interaction has been identified as a protective factor for father's anxiety during the transition to parenthood, interventions should engage couples in both decreasing negative and increasing positive interactions (e.g., Pilkington et al., 2015). Couple-focused interventions over the transition to parenthood have demonstrated good outcomes on variables such as parental mental

health, parenting, coparenting and child adjustment (e.g., Feinberg et al., 2016).

Significant variability was found in fathers' and mothers' anxiety and depression symptoms trajectories (see Tables 4 and 5), indicating that additional variables (such as co-parenting relationship and family support) could explain additional variance in these trajectories over time. Despite the longitudinal aspect of the models, a possible causal relationship need to be taken with caution. Cross-lagged designs might be used in future studies to explore mediation effects.

### Conflict of interest

There is no conflict of interest.

### Contributors

All authors participated in the study design. B. F. and C. C. collected the data, undertook the statistical analysis, interpreted the results, and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

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